KOINONIA FEDERATION – ALL THROUGH SUBJECT MAP

SUBJECT: Computing

CURRICULUM INTENT: We want our pupils to develop an interest in the field of computer science by providing them with the knowledge, understanding and skills to support them in the fast-paced world of technology; while ensuring that they understand the potential dangers of modern technology, and are able to use it safely.

We aim for pupils to develop their ability to solve computational problems using a range of programming skills, consisting of both visual and textual programming languages. Our intent is to enable pupils to not only become confident users but creators of technology.

Please identify what the key themes / concepts are, that all students at all key stages will study in your subject.

These will obviously get progressively more challenging in terms of content / expectations as the years progress and different language might be used to describe them however, they should still be able to fit under a blanket heading.

Please allocate a colour to each of these themes so that it is clear how they are revisited and built upon throughout the curriculum. Please add or remove as appropriate

Programming Skills	Digital literacy and skills	Hardware/Software	Logic

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	AUTUMN 1	AUTUMN 2	SPRING 1	SPRING 2	SUMMER 1	SUMMER 2
NURSERY – KEY THEMES / CONCEPTS	**Wider Technology**			**Computing Devices**		
NURSERY – KEY CONTENT / LEARNING	Pupils will learn to operate mechanical toys, e.g., turns knob on wind-up toy or pulls back on a friction car. Pupils will learn how to operate simple equipment. Pupils will learn to use buttons to play back songs, sound recording or videos. Pupils will learn about real objects such as cameras and mobile phones and their basic functions.			Pupils will learn to use a single button mouse to drag and drop. Pupils will learn that text and images on a computer can be printed out. Pupils will learn to use arrow keys on a keyboard to control movement on the screen.		
RECEPTION - KEY THEMES / CONCEPTS	**Wider Technology**			**Computing Devices**		
RECEPTION - KEY CONTENT/ LEARNING	Pupils will learn to operate mechanical toys, e.g., turns knob on wind-up toy or pulls back on a friction car. Pupils will learn how to program a simple floor robot with a series of instructions. Pupils will learn how to use play, pause and stop buttons when playing back on recording devices.			Pupils will learn to use a single button mouse to drag and drop. Pupils will learn that text and images on a computer can be printed out. Pupils will learn to use arrow keys on a keyboard to control movement on the screen. Pupils will start to learn that the internet can be used for research purposes.		
YEAR 1 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating Media**	**Programming A**	**Data and Information**	**Creating Media**	**Programming B**
	Technology around us	Digital painting	Moving a robot	Grouping data	Digital writing	Programming animations
YEAR 1 - KEY CONTENT/ LEARNING	Pupils will be taught to recognise technology in school and how to use it responsibly.	Pupils will learn to choose appropriate tools in a program to create art and make comparisons to working non-digitally.	Pupils will write short algorithms and programs for floor robots and predict program outcomes.	Pupils will explore object labels, then using them to sort and group objects by their properties.	Pupils will use a computer to create and format text, before comparing to writing non-digitally.	Pupils will design and program the movement of a character on screen to tell stories.

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YEAR 2 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating Media**	**Programming A**	**Data and Information**	**Creating Media**	**Programming B**
	Information Technology around us	Digital Photography	Robot algorithms	Pictograms	Digital music	Programming quizzes
YEAR 2 - KEY CONTENT/ LEARNING	Pupils will identify IT and how its responsible use improves our world in school and beyond.	Pupils will capture and change digital photographs for different purposes.	Pupils will create and debug programs and use logical reasoning to make predictions.	Pupils will collect data in tally charts and using attributes will organise and present data on a computer.	Pupils will use a computer as a tool to explore rhythms and melodies, before creating a musical composition.	Pupils will design algorithms and programs that use events to trigger sequences of code to make an interactive quiz.
YEAR 3 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating Media**	**Programming A**	**Data and Information**	**Creating Media**	**Programming B**
	Connecting computers	Stop-frame animation	Sequencing sounds	Branching databases	Desktop Publishing	Events and actions in programs
YEAR 3 - KEY CONTENT/ LEARNING	Pupils will identify that digital devices have inputs and outputs. How devices can be connected to make networks.	Pupils will capture and edit digital still images to produce a stop-frame animation that tells a story.	Pupils will create sequences in a block-based programming language to make music.	Pupils will build and use branching databases to group objects using yes/no questions.	Pupils will create documents by modifying text, images and page layouts for a specified purpose.	Pupils will write algorithms and programs that use a range of events to trigger sequences of actions.
YEAR 4 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating media**	**Programming A**	**Data and information**	**Creating media**	**Programming B**
	The internet	Audio production	Repetition in shapes	Data logging	Photo editing	Repetition in games

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YEAR 4 - KEY CONTENT/ LEARNING	Pupils will recognise the internet as a network of networks including the WWW (World Wide Web). Learning why we should evaluate online content.	Pupils will capture and edit audio to produce a podcast, ensuring that copyright is considered.	Pupils will use a text-based programming language to explore count-controlled loops when drawing shapes.	Pupils will recognize how and why date is collected over time, before using data loggers to carry out an investigation.	Pupils will learn to manipulate digital images, reflect on the impact of changes and whether the required purpose is fulfilled.	Pupils will use a block-based programming language to explore count-controlled and infinite loops when creating a game.
YEAR 5 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating media**	**Programming. A**	**Data and information**	**Creating media**	**Programming B**
	Systems and searching	Video production	Selection in physical computing	Flat-file databases	Introduction to vector graphics	Repetition in quizzes
YEAR 5 - KEY CONTENT/ LEARNING	Pupils will learn to recognise IT systems in the world and how some can enable searching on the internet.	Pupils will plan, capture and edit video to produce a short film.	Pupils will explore conditions and selection using a programmable microcontroller.	Pupils will learn to use a database to order data and create charts to answer question.	Pupils will create images in a drawing program by using layers and groups of objects.	Pupils will explore selection in programming to design and code an interactive quiz.
YEAR 6 - KEY THEMES / CONCEPTS	**Computing systems and networks**	**Creating Media**	**Programming A**	**Data and information**	**Creating media**	**Programming B**
	Communication and collaboration	Webpage creation	Variable in games	Introduction to spreadsheets	3D modelling	Sensing movements
YEAR 6 - KEY CONTENT/ LEARNING	Pupils will learn how data is transferred by working collaboratively online.	Pupils will design and create webpages, giving consideration to copyright, aesthetics and navigation.	Pupils will explore variables when designing and coding a game.	Pupils will learn to answer question by using spreadsheets to organise and calculate data.	Pupils will plan, develop and evaluate 3D computer models of physical objects.	Pupils will design and code a project that captures inputs from a physical device.
YEAR 7 - KEY	E-Safety Computer literacy Online threats	Computer systems Hardware and software. Data representation.	Data Representation Binary/denary conversion	Algorithms Flowchart symbols Flowcharts	Variables Operators String	Block programming with scratch

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THEMES / CONCEPTS	Privacy Cyber-bullying Digital footprint	Input-Process-Output cycle. Input and output devices.	Data vs. information Structured data Data types	Sequence Selection Iteration	Integer Boolean Real/float	
YEAR 7 - KEY CONTENT/ LEARNING	1. Understands how to recognise and be legally and emotionally safe from threats such as grooming, sexting and cyber bullying. 2. Understands the importance of communicating safely and respectfully online, and the need for keeping personal information private. Your online digital presence. 3. Confidently uses PC based systems to create, rename and edit different file types. 4. Obtains content from the world wide web using a web browser.	1. Classifies a range of software including operating systems, utility and application software. Explains the difference between hardware and software, and their roles within a computer system. 2. Gives examples of how data is stored on a computer. Explains the function of the main internal parts of basic computer architecture. 3. Outlines the concepts behind the input-process-output cycle. Recognises that a range of digital devices can be considered a computer. 4. Recognises and can classify a range of input and output devices.	1. Classifies different types of data and understands how these are used in different situations. 2. Understands the difference between data and information. 3. Recognises that data can be structured in tables to make it useful. 4. Understands why a computer stores data in binary 5. Can convert denary to binary and vice versa 6. Add two binary numbers	1. Defines what an algorithm is. 2. Interprets and creates algorithms that use simple real-world sequences. 3. Use sequence, selection and iteration in flowcharts 4. Understand the four basic data types used in algorithms 5. Understand what a variable is 6. Understand how to assign and compare variables using operators 7. Interprets and creates simple flowcharts using sequence, operators and variables. 8. defines decomposition and abstraction	1. Defines what an algorithm is. 2. Interprets and creates algorithms that use simple real-world sequences. 3. Use sequence, selection and iteration in flowcharts 4. Understand the four basic data types used in algorithms 5. Understand what a variable is 6. Understand how to assign and compare variables using operators 7. Interprets and creates simple flowcharts using sequence, operators and variables. 8. defines decomposition and abstraction	1. Create block structures for sequence, selection and iteration 2. Move a sprite based upon user input events 3. Move a sprite using iteration with no user input 4. Detect collision between sprites 5. Write a simple game which includes user input control, moving sprites and collision detection
YEAR 8 - KEY	Computer systems Hardware and software. Data representation.	Data representation Concepts of number bases	Definition of network and network types.	Computational thinking Algorithms	The use of spreadsheets for data storage Create spreadsheets	The use of spreadsheets for data storage

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THEMES / CONCEPTS	Input-Process-Output cycle. Input and output devices.	Why we use binary. Why we use hexadecimal. Binary/denary conversions	Cloud based networking. Internet vs WWW. Network connection technologies.	Flowchart symbols Flowcharts Sequence Selection Iteration		Create spreadsheets
YEAR 8 - KEY CONTENT/ LEARNING	1. Classifies a range of software including operating systems, utility and application software. Explains the difference between hardware and software, and their roles within a computer system. 2. Gives examples of how data is stored on a computer. Explains the function of the main internal parts of basic computer architecture. 3. Outlines the concepts behind the input-process-output cycle. Recognises that a range of digital devices can be considered a computer. 4. Recognises and can classify a range of input and output devices.	1. Be able to convert from denary to binary and binary to denary 2. Be able to add two 8-bit binary numbers 3. To understand why bases over 10 need symbolic representations 4. To be able to convert from hex to denary and denary to hex 5. To be able to convert from hex to binary and binary to hex	1. Define a network and know the differences between LAN and WAN 2. Understand the differences between client server and P2P networks 3. Understands the difference between the internet and the WWW 4. Understand how data is stored remotely on servers or cloud 5. Know the advantages and disadvantages of cloud-based systems 6. Understand different connection methods such as Bluetooth, wi-fi and ethernet	1. Defines what an algorithm is. 2. Interprets and creates algorithms that use simple real-world sequences. 3. Use sequence, selection and iteration in flowcharts 4. Understand the four basic data types used in algorithms 5. Understand what a variable is 6. Understand how to assign and compare variables using operators 7. Interprets and creates simple flowcharts using sequence, operators and variables. 8. defines decomposition and abstraction	1. Makes judgements about digital content when evaluating and repurposing it for a given audience. Recognises the audience when designing and creating digital content. 2. Undertakes creative projects that collect, analyse, and evaluate data to meet the needs of a known user group. Effectively designs and creates digital artefacts for a wider or remote audience. 3. Uses a variety of software to manipulate and present digital content: data and information. 4. Evaluates their work and makes improvements to solutions based on feedback received.	1. Makes judgements about digital content when evaluating and repurposing it for a given audience. Recognises the audience when designing and creating digital content. 2. Undertakes creative projects that collect, analyse, and evaluate data to meet the needs of a known user group. Effectively designs and creates digital artefacts for a wider or remote audience. 3. Uses a variety of software to manipulate and present digital content: data and information.

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						4. Evaluates their work and makes improvements to solutions based on feedback received.
YEAR 9 - KEY THEMES / CONCEPTS	LAN vs WAN Network topologies Internet protocol Common network protocols	Concepts of number bases Why we use binary. Why we use hexadecimal. Binary/denary conversions Boolean logic Truth tables Logic gates AND gate OR gate NOT gate Boolean algebra	Computational thinking Abstraction Decomposition Pattern recognition Algorithms Flowcharts Sequence Selection Iteration	Memory and storage. FDE cycle. Virtual memory.	Data types Operators Basic python syntax	Programming project
YEAR 9 - KEY CONTENT/ LEARNING	1. Know the hardware that comprises a typical LAN 2. Understand network topologies and how they affect the resilience of a network 3. Understand the concept of data transfer protocols	1. Be able to convert from denary to binary and binary to denary 2. Be able to add two 8-bit binary numbers 3. To be able to convert from hex to denary and denary to hex	1. Defines what an algorithm is. 2. Interprets and creates algorithms that use simple real-world sequences. 3. Use sequence, selection and iteration in flowcharts	1. Understand how data and instructions are stored in main memory and how instructions are fetched from memory to be processed by the CPU 2. Understand the concept of secondary	1. Know the basic data types and operators in Python 2. Demonstrate input and output and variable assignation in Python 3. Interpret and create Python programs using sequence, selection,	1. Prepare requirements for a self-determined programming project 2. Build, test and evaluate a non-trivial program (or set of programs) to fulfil the requirements

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	4. Describe in detail how data is split into packets and transferred over a network using the internet protocol 5. Know a range of common network protocols	4. To be able to convert from hex to binary and binary to hex 5. Understand the concept of digital vs analog systems 6. Relate real world systems to using AND, OR and NOT gates to represent possible outcomes 7. Write truth tables for AND, OR and NOT logic gates 8. Write logic diagrams based upon truth tables for AND, OR and NOT 9. Write truth tables for logic circuits with more than one logic gate 10. Draw logic circuits for truth tables representing systems with more than one logic gate	4. Understand what a variable is 5. Understand how to assign and compare variables using operators 6. Interprets and creates simple flowcharts using sequence, operators and variables. 7. Understand the 4 computational thinking techniques	storage and know a range of secondary storage devices 3. Evaluate secondary storage devices and be able to choose appropriately based upon speed, robustness, capacity and portability 4. Understand the concept of virtual memory and explain its importance 5. Predict possible computer systems of the future.	iteration, variables and operators 4. Test trivial Python programs using trace tables 5. Identify and fix logic and syntax bugs in Python programs	3. Use functions and persistence using files in a non-trivial program
YEAR 10 - KEY THEMES / CONCEPTS	Computer Systems Common CPU components and their functions Characteristics of CPU and the way they affect	Primary storage Secondary storage Strands of data storage Data storage Characters Images Sound	Searching and sorting algorithms Computational thinking techniques Designing, creating and refining algorithms	Variables and constants Data types Operators Programming constructs - Sequence	String manipulation File handling Data storage and SQL Arrays Subprograms Random number generator	Types of networks (LAN and WAN) Factors that affect network performance Client-server and P2P networks Network hardware

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	the performance of the CPU Embedded systems Secondary storage	Compression		- Selection - Iteration		The internet Network topologies Wired and wireless networks Encryption IP and MAC addressing Standards Network protocols Concept of layers
YEAR 10 - KEY CONTENT/ LEARNING	Computer Systems - The purpose of the CPU - The fetch-execute cycle - Common CPU components and their function: ALU (Arithmetic Logic Strand), CU (Control Strand), Cache, Registers, MAR (Memory Address Register), MDR (Memory Data Register), Program Counter, Accumulator - CPU performance: How common characteristics of CPUs affect their performance: - Clock speed	Primary storage: - The need for primary storage - Difference between RAM and ROM - Purpose of RAM and ROM in a computer system - Virtual memory Secondary storage: The need for secondary storage Common types of storage: - Optical, magnetic and solid state Suitable storage devices and storage media for a given application. The advantages and disadvantages of different storage	Searching and sorting algorithms - Binary search - Linear search - Bubble sort - Merge sort - Insertion sort Computational thinking techniques - Abstraction - Decomposition - Algorithmic thinking Designing, creating and refining algorithms - Identify the inputs, processes and outputs for a problem - Structure diagrams - Create, interpret, correct, complete and refine algorithms using pseudocode, flowcharts and reference	Data types The use of data types - Integer, real/float, Boolean, character and string - Casting The use of variables, constants, operators, input, outputs and assignment Programming constructs - Sequence, selection, iteration Arithmetic operators Boolean operators - AND, OR, NOT	*Revisit previously taught programming techniques* Use of basic string manipulation - String slicing, indexing, LEN Use of basic file handling operations - Open, read, write, close The use of records to store data The use of SQL to search for data The use of arrays (or equivalent) when solving problems, including 1D and 2D arrays. Subprograms - Functions and procedures	Networks and topologies - Types of networks: -LAN (Local Area Network) -WAN (Wide Area Network) Factors that affect the performance of networks -The different roles of computers in a client-server and a peer-to-peer network The hardware needed to connect stand-alone computers into a Local Area Network: -Wireless access points, Routers, Switches, -NIC (Network Interface

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	- Cache size - Number of cores Embedded systems: The purpose and characteristics of embedded system Examples of embedded systems Secondary storage: The need for secondary storage Common types of storage: - Optical - Magnetic - Solid state Suitable storage devices and storage media for a given application. The advantages and disadvantages of different storage devices and storage media relating to these characteristics: Capacity, Speed, Portability, Durability, Reliability, Cost	devices and storage media relating to these characteristics: Capacity, Speed, Portability, Durability, Reliability, Cost Units of data storage - Bit, nibble, byte, KB, MB, GB, TB, PB - How data needs to be converted to binary - Data capacity and calculations Data storage and conversions - Denary to binary conversions and vice versa - Denary to hexadecimal conversions and vice versa - Bit shifting - Binary addition and overflow errors Characters - What is a character? - ASCII and Unicode character sets Images - How an image is represented as a series of pixels, and represented in binary	language/high-level programming language		Random number generator	Controller/Card), Transmission media The Internet as a worldwide collection of computer networks: -DNS (Domain Name Server) -Hosting -The Cloud -Web servers and clients -Star and Mesh network topologies Wired and wireless networks, protocols and layers: Modes of connection: Wired, Ethernet, Wireless, Wi-Fi, Bluetooth, Encryption, IP addressing and MAC addressing Standards Common protocols including: TCP/IP, HTTP, HTTPS, FTP, POP, IMAP, SMTP The concept of layers

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		- Metadata - Colour depth and resolution and its effect on the size and quality of an image file Sound - How is sound sampled and stored in digital form - Effect of sample rate, duration and bit depth on the playback quality and size of the sound file Compression - Need for compression - Lossy and lossless compression				
YEAR 11 - KEY THEMES / CONCEPTS	Threats to computer systems and networks - Forms of attack Identifying and preventing vulnerabilities - Common prevention methods	The purpose and functionality of operating systems The purpose and functionality of utility software	Defensive design considerations High-level and low-level programming languages Translators IDEs Ethical, legal, cultural and environmental impacts of digital technology on wider society Legislation relevant to computer science	Exam Prep and Revision	Exam Prep and Revision	

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YEAR 11 - KEY CONTENT/ LEARNING	Forms of attack - Malware - Social engineering e.g., phishing, people as the "weak point" - Brute force - Denial of service attacks - Data interception and theft - The concept of SQL injection Common prevention methods - Penetration testing - Anti-malware software - Firewalls -User access levels - Passwords - Encryption - Physical security	The purpose and functionality of operating systems - User interface -Memory management and multitasking -Peripheral management and drivers - User management - File management The purpose and functionality of utility software - Encryption software - Defragmentation - Data compression (Lossy and lossless)	Defensive design considerations - Anticipating misuse - Authentication Input validation Maintainability - Use of sub-programs - Naming conventions - Indentation - Commenting Characteristics and purpose of different levels of programming languages: - High-level and low-level languages - The purpose of translators - The characteristics of a compiler and an interpreter The IDE Common tools and facilities in an IDE - Editors - Error diagnostics - Run-time environment - Translators impacts of digital technology on wider society including: - Ethical issues - Legal issues	Exam Prep and Revision	Exam Prep and Revision	

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			- Cultural issues - Environmental issues - Privacy issues Legislation relevant to computer science - The data protection act 2018 - Computer misuse act 1990 - Copyright designs and patents act 1988 - Software licences (i.e., open source and proprietary)			
YEAR 12 - KEY THEMES / CONCEPTS	Structure and function of the processor. Types of processors Input, output and storage	Structure and function of the processor. Types of processors Input, output and storage	Systems software Applications generation	Software development Types of programming languages	Comprehension, encryption and hashing Databases Networks	Web technologies Data types Data structures
YEAR 12 - KEY CONTENT/ LEARNING	The Arithmetic and Logic Unit; ALU, Control Unit and Registers (Program Counter; PC, Accumulator; ACC, Memory Address Register; MAR, Memory Data Register; MDR, Current Instruction Register; CIR). Buses: data, address and control: how this relates	The use of pipelining in a processor to improve efficiency. Von Neumann, Harvard and contemporary processor architecture. The differences between and uses of	The need for, function and purpose of operating systems. Memory Management (paging, segmentation and virtual memory). Interrupts, the role of interrupts and Interrupt Service Routines (ISR), role within the Fetch-Decode-Execute Cycle.	Understand the waterfall lifecycle, agile methodologies, extreme programming, the spiral model and rapid application development. The relative merits and drawbacks of different methodologies and	Lossy vs Lossless compression. Run length encoding and dictionary coding for lossless compression. Symmetric and asymmetric encryption. Different uses of hashing.	HTML, CSS and JavaScript. See appendix 5d. Search engine indexing. PageRank algorithm. Server and client-side processing. Primitive data types, integer, real/floating point, character, string and Boolean.

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	to assembly language programs. The Fetch-Decode-Execute Cycle; including its effects on registers. The factors affecting the performance of the CPU: clock speed, number of cores, cache.	CISC and RISC processors. GPUs and their uses (including those not related to graphics). Multicore and Parallel systems. How different input, output and storage devices can be applied to the solution of different problems. The uses of magnetic, flash and optical storage devices. RAM and ROM. Virtual storage.	Scheduling: round robin, first come first served, multi-level feedback queues, shortest job first and shortest remaining time. Distributed, embedded, multi-tasking, multi-user and Real Time operating systems. BIOS. Device drivers. Virtual machines, any instance where software is used to take on the function of a machine, including executing intermediate code or running an operating system within another The nature of applications, justifying suitable applications for a specific purpose. Utilities. Open-source vs closed source. Translators: Interpreters, compilers and assemblers.	when they might be used. Writing and following algorithms Need for and characteristics of a variety of programming paradigms. Procedural languages. Assembly language (including following and writing simple programs with the Little Man Computer instruction set). See appendix 5d. Modes of addressing memory (immediate, direct, indirect and indexed). Object-oriented languages (see appendix 5d for pseudocode style) with an understanding of classes, objects, methods, attributes, inheritance, encapsulation and polymorphism.	Relational database, flat file, primary key, foreign key, secondary key, entity relationship modelling, normalisation and indexing. See appendix 5f. Methods of capturing, selecting, managing and exchanging data. Normalisation to 3NF. (d) SQL – Interpret and modify. See appendix 5d. Referential integrity. Transaction processing, ACID (Atomicity, Consistency, Isolation, Durability), record locking and redundancy Characteristics of networks and the importance of protocols and standards. The internet structure: • The TCP/IP Stack. • DNS • Protocol layering. • LANs and WANs. • Packet and circuit switching.	Represent positive integers in binary. Use of sign and magnitude and two's complement to represent negative numbers in binary. Addition and subtraction of binary integers. Represent positive integers in hexadecimal. Convert positive integers between binary hexadecimal and denary. Representation and normalisation of floating point numbers in binary. Floating point arithmetic, positive and negative numbers, addition and subtraction. Bitwise manipulation and masks: shifts, combining with AND, OR, and XOR. How character sets (ASCII and UNICODE)

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			Stages of compilation (lexical analysis, syntax analysis, code generation and optimisation). Linkers and loaders and use of libraries.		Network security and threats, use of firewalls, proxies and encryption. Network hardware. Client-server and peer to peer	are used to represent text. Arrays (of up to 3 dimensions), records, lists, tuples. The following structures to store data: linked-list, graph (directed and undirected), stack, queue, tree, binary search tree, hash table. How to create, traverse, add data to and remove data from the data structures mentioned above. (NB this can be either using arrays and procedural programming or an object-oriented approach).
YEAR 13 - KEY THEMES / CONCEPTS	Fundamentals of Computer Systems (External assessment – Exam)		Optional internal assessment unit		Exam prep and revision	
YEAR 13 - KEY CONTENT/ LEARNING	Learners study the fundamental principles of how computer systems work, including the role of hardware and software, the way components of a		Content taught is dependent on the learners' chosen unit.		Exam prep and revision	

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	system work together and how data in a system is used.		